



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

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CIHS

Syllabus
2025 - 2026

GENERAL INFORMATION

Data of the subject	
Subject name	Power Electronics Applications
Subject code	DEA-GITI-448
Main program	Bachelor's Degree in Engineering for Industrial Technologies
Involved programs	Grado en Ingeniería en Tecnologías Industriales [Fourth year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	4,5 ECTS
Type	Optativa (Grado)
Department	Department of Electronics, Control and Communications
Coordinator	Pablo García González
Schedule	Morning sessions

Teacher Information	
Teacher	
Name	Johel Jose Rodriguez D'Derlee
Department	Department of Electronics, Control and Communications
E-Mail	jjrodriguez@icai.comillas.edu
Teacher	
Name	Pablo García González
Department	Department of Electronics, Control and Communications
Office	Alberto Aguilera 25 [221]
E-Mail	pablo@comillas.edu
Phone	6105
Teacher	
Name	Jaime de la Peña Llerandi
Department	Department of Electronics, Control and Communications
E-Mail	jpllerandi@icai.comillas.edu

DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites
Students must have taken a course on electric circuit analysis, and have basic knowledge of Fourier Series and control systems.



Course contents

Contents

Theory:

1. Introduction.
 - What power electronics is and application examples.
 - Principles of energy conversion using power electronics.
 - Analysis of circuits with periodic voltage and current sources.
 - Power quality: definition of the most important concepts and electrical magnitudes.
2. AC-DC converters.
 - Introduction: power diode switching principles.
 - Single-phase rectifiers.
 - Three-phase rectifiers.
 - Application example: HVDC system.
3. DC-AC converters.
 - Introduction: power transistor switching principles.
 - Single-phase inverter: square wave and Pulse Width Modulation (PWM).
 - Three-phase inverter: square wave and Pulse Width Modulation (PWM).
 - Park's Transformation and current control.
 - Application example: control system of a STATic synchronous COMPensator (STATCOM).
4. DC-DC converters.
 - Operation principles.
 - Basic converters: Buck, Boost and Buck-Boost converter.

Laboratory:

The lab will be taught in 2-hour sessions. Students will design the current control system of a three-phase inverter to exchange real and instantaneous reactive power with the power grid. The control system will be implemented in Simulink, including switches, voltage and current probes and signal filters.

EVALUATION AND CRITERIA

The use of AI to produce full assignments or substantial parts thereof, without proper citation of the source or tool used, or without explicit permission in the assignment instructions, will be considered plagiarism and therefore subject to the University's General Regulations.

Grading

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The following conditions must be accomplished to pass the course:



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- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 4 over 10.

The overall grade is obtained as follows:

- Final exam 50%.
- Quizzes 30%: two or three 50-min quizzes.
- Lab evaluation 20%.

BIBLIOGRAPHY AND RESOURCES

Basic References

D.H. Hart. Power Electronics. McGraw-Hill, 2010.

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